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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/091,106	03/05/2002	John Commander	CEDE 2036	5919
321	7590	03/24/2004	EXAMINER	
SENNIGER POWERS LEAVITT AND ROEDEL			WONG, EDNA	
ONE METROPOLITAN SQUARE			ART UNIT	
16TH FLOOR			PAPER NUMBER	
ST LOUIS, MO 63102			1753	

DATE MAILED: 03/24/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 10/091,106	Applicant(s) COMMANDER ET AL.	
	Examiner Edna Wong	Art Unit 1753	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-20, 28-35 and 43-59 is/are pending in the application.
- 4a) Of the above claim(s) 8-11, 13, 15-18, 20, 29-32, 34, 48-51 and 53-59 is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 1-7, 14, 28, 33, 35, 43-47 and 52 is/are rejected.
- 7) ☒ Claim(s) 12 and 19 is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on ____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
 Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
 Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
 a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. ____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|--|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. ____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date <u>1/29/03</u> . | 6) <input type="checkbox"/> Other: ____ |

Election/Restrictions

Applicant's election without traverse of Group I, specie (e), claims **1-7, 12, 14, 19, 28, 33, 35, 43-47 and 52**, in Amendment A is acknowledged.

The requirement is still deemed proper and is therefore made FINAL.

Accordingly, claims **8-11, 13, 15-18, 20, 29-32, 34, 48-51 and 53-59** are withdrawn from consideration as being directed to a non-elected invention.

Applicants state that "wherein the defect reducing agent is a reaction product of benzyl chloride and hydroxyethyl polyethylenimine" (claims 10 and 54-59) also fall within the specie of the reaction product of 1-chloromethylnaphthalene and hydroxyethyl polyethylenimine.

However, the Examiner disagrees with this statement because the specie of a reaction product of benzyl chloride and hydroxyethyl polyethylenimine was indicated separately as **specie (c)** on page 4 of the Restriction Requirement dated December 9, 2003, and Applicants were to elect a single disclosed species for prosecution on the merits and Applicants have not traversed on the ground that the species are not patentably distinct. Applicants should submit evidence or identify such evidence now of record showing the species to be obvious variants or clearly admit on the record that this is the case. In either instance, if the examiner finds one of the inventions unpatentable over the prior art, the evidence or admission may be used in a rejection under 35 U.S.C. 103(a) of the other invention.

Specification

The disclosure is objected to because of the following informalities:

page 10, line 9, reference character "12" has been used to designate both a cathode and a substrate (from page 9, line 35). It is unclear what reference character "12" designates.

page 10, line 25, reference character "12a" has been used to designate both the cathode surface, the wafer substrate (from page 10, lines 11-12) and the surface (from page 11, line 4). It is unclear what reference character "12a" designates.

page 11, line 1, reference character "11" has been used to designate both a holding tank and an electroplating tank (from page 10, lines 4-5). It is unclear what reference character "11" designates.

Appropriate correction is required.

Claim Rejections - 35 USC § 112

I. Claims 2, 44 and 46 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 2

line 3, it appears that the "electroplating" is the same as that recited in claim 1, line 9. However, it is unclear if it is. If it is, then it is suggested that the word -- the -- be inserted before the word "electroplating".

Claim 44

line 3, it appears that the "electroplating" is the same as that recited in claim 43, line 2. However, it is unclear if it is. If it is, then it is suggested that the word -- the -- be inserted before the word "electroplating".

Claim 46

lines 1-2, "the electroplating bath containing the concentrate" lacks antecedent basis.

II. Claims **28, 33, 35, 43-47 and 52** are rejected under 35 U.S.C. 112, second paragraph, as being incomplete for omitting essential elements, such omission amounting to a gap between the elements. See MPEP § 2172.01. The omitted elements are: copper.

Claims 28 and 43

lines 1-2, the preamble recites "A concentrate for preparation of a copper electroplating bath for electroplating a copper deposit onto a semiconductor integrated

circuit device substrate". However, the body of the claim does not recite copper in the concentrate.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Concentrate

I. Claim **28 and 35** are rejected under 35 U.S.C. 102(b) as being anticipated by **Dubin et al.** (US Patent No. 5,972,192).

Dubin teaches a concentrate comprising a defect reducing agent (= a leveling agent) [col. 6, lines 15-27].

As for preparation of a copper electroplating bath for electroplating a copper deposit onto a semiconductor integrated circuit device substrate having electrical interconnect features including submicron-sized features such that the surface has submicron-sized reliefs therein, this claim limitation does not compositionally distinguish the concentrate from the prior art.

As to which reduces the occurrence of protrusion defects from superfilling,

surface roughness, and voiding due to uneven growth, and improves macro-scale planarity across the wafer, this claim limitation does not compositionally distinguish the concentrate from the prior art.

This claim limitation is a result of carrying out a method.

As to wherein the defect reducing agent reduces a rate of recrystallization and grain growth in copper deposited using said copper electroplating bath, thereby reducing the formation of internal voids in the deposited copper, this claim limitation does not compositionally distinguish the concentrate from the prior art.

This claim limitation is a result of carrying out a method.

II. Claim **43-47** are rejected under 35 U.S.C. 102(b) as being anticipated by **Dubin et al.** (US Patent No. 5,972,192).

Dubin teaches a concentrate comprising a defect reducing agent (= a leveling agent) [col. 6, lines 15-27].

As for preparation of a copper electroplating bath for electroplating a copper deposit onto a semiconductor integrated circuit device substrate having electrical interconnect features including submicron-sized features such that the surface has submicron-sized reliefs therein, this claim limitation does not compositionally distinguish the concentrate from the prior art.

This claim limitation is a result of carrying out a method.

As to which yields a copper deposit having an overall surface which is more level than a comparable overall surface electroplated without the defect reducing agent, this claim limitation does not compositionally distinguish the concentrate from the prior art.

This claim limitation is a result of carrying out a method.

As to wherein the defect reducing agent reduces high current density edge effect during electroplating; wherein the defect reducing agent improves distribution of deposited copper over the substrate surface; wherein the electroplating bath containing the concentrate yields a deposit thickness of about 1 micron and which varies by no more than about 0.2 microns across the deposit, the deposit thickness being measured from an upper surface of the deposit to the substrate surface at its thickest point; wherein the defect reducing agent facilitates deposition of a thinner overall deposit to achieve a minimum thickness across the substrate than an overall deposit required to achieve such minimum thickness by electroplating without said defect reducing agent, these claim limitation do not compositionally distinguish the concentrate from the prior art.

These claim limitations are a result of carrying out a method.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Method

I. Claims 1-7 are rejected under 35 U.S.C. 103(a) as being unpatentable over **Dubin et al.** (US Patent No. 5,972,192).

Dubin teaches a method for electroplating a copper deposit onto a semiconductor integrated circuit device substrate with electrical interconnect features including submicron-sized features such that the surface has submicron-sized reliefs therein (col. 1, lines 5-10), the method comprising the steps of:

(a) immersing the substrate into an electroplating bath including ionic copper (= Cu^{2+} cations) and an effective amount of a defect reducing agent (= a leveling agent) [col. 6, lines 15-27]; and

(b) electroplating the copper deposit from said bath onto the substrate to fill the submicron-sized reliefs whereby the occurrence of protrusion defects from superfilling (= high aspect ratio openings were filled with Cu having a thickness not exceeding the thickness of the deposited Cu layer), and voiding due to uneven growth are reduced (= seam-free fillings), and macro-scale planarity across the wafer (= enhanced uniformity) is improved (col. 6, lines 35-58).

The defect reducing agent improves distribution of deposited copper over the substrate surface (col. 7, lines 25-37).

Dubin does not teach whereby the occurrence of surface roughness is improved.

However, the invention as a whole would have been obvious to one having ordinary skill in the art at the time the invention was made because similar processes can reasonably be expected to yield products which inherently have the same properties. *In re Spada* 15 USPQ 2d 1655 (CAFC 1990); *In re DeBlauwe* 222 USPQ 191; *In re Wiegand* 86 USPQ 155 (CCPA 195).

As to wherein the defect reducing agent reduces high current density edge effect during electroplating, it has been held that a newly discovered use or function of components does not necessarily mean the system is unobvious since this use or function may be inherent in the prior art. *Ex parte Pfeiffer* 135 USPQ 31.

As to wherein the deposit has a deposit thickness of about 1 micron and which varies by no more than about 0.2 microns across the deposit, this is well within the skill of the artisan dependent upon the intended use of the device, particularly to the environment to which the device will encounter, which would be most suited for the application of the device, absent evidence to the contrary.

Furthermore, this is well within the skill of the artisan dependent upon the size of the features.

As to the deposit thickness being measured from an upper surface of the deposit to the substrate surface at its thickest point, if the deposit thickness varies by no more than about 0.2 microns across the deposit, then measuring the deposit thickness at its thickest point would have revealed this, and that any other point beyond this would have been outside this range.

As to wherein the defect reducing agent facilitates deposition of a thinner overall deposit to achieve a minimum thickness across the substrate than an overall deposit required to achieve such minimum thickness by electroplating without said defect reducing agent, it has been held that a newly discovered use or function of components does not necessarily mean the system is unobvious since this use or function may be inherent in the prior art. *Ex parte Pfeiffer* 135 USPQ 31.

As to removing a portion of the copper deposit by chemical and mechanical action to yield a level substrate, this is well within the skill of the artisan because chemical mechanical polishing (CMP) is conventional in the art to remove excess conductive material on the surface of a dielectric interlayer (see Dubin, col. 1, lines 48-

50).

As to wherein an amount of copper deposit to be removed is less than an amount of copper deposit which must be removed by chemical and mechanical action to yield a level substrate in a comparable substrate electroplated without said defect reducing agent, Dubin appears to disclose a method at least in a similar manner as instantly claimed. Therefore, it would have been within the skill of the art to expect that an amount of copper deposit to be removed is less than an amount of copper deposit which must be removed by chemical and mechanical action to yield a level substrate in a comparable substrate electroplated without said defect reducing agent, unless proven otherwise.

As to wherein pitting corrosion from said chemical action is less severe than pitting corrosion in the comparable substrate electroplated without said defect reducing agent, Dubin appears to disclose a method at least in a similar manner as instantly claimed. Therefore, it would have been within the skill of the art to expect that pitting corrosion from said chemical action is less severe than pitting corrosion in the comparable substrate electroplated without said defect reducing agent, unless proven otherwise.

II. Claim 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over **Dubin et al.** (US Patent No. 5,972,192).

Dubin et al. is as applied above and incorporated herein.

Dubin does not teach a defect reducing agent which reduces a rate of recrystallization and grain growth in the copper deposit.

However, the invention as a whole would have been obvious to one having ordinary skill in the art at the time the invention was made because it has been held that a newly discovered use or function of components does not necessarily mean the system is unobvious since this use or function may be inherent in the prior art. *Ex parte Pfeiffer* 135 USPQ 31.

As to which deposit subsequently undergoes recrystallization and grain growth at a reduced rate, Dubin appears to disclose a method at least in a similar manner as instantly claimed. Therefore, it would have been within the skill of the art to expect that the deposit subsequently undergoes recrystallization and grain growth at a reduced rate, unless proven otherwise.

Allowable Subject Matter

The following is a statement of reasons for the indication of allowable subject

matter:

Claim **12** defines over the prior art of record because the prior art does not teach or suggest the method of claim 1 wherein the defect reducing agent is the reaction product of 1-chloromethylnaphthalene and hydroxyethyl polyethylenimine.

Claim **19** defines over the prior art of record because the prior art does not teach or suggest the method of claim 14 wherein the defect reducing agent is the reaction product of 1-chloromethylnaphthalene and hydroxyethyl polyethylenimine.

Claim **33** defines over the prior art of record because the prior art does not teach or suggest the method of claim 28 wherein the defect reducing agent is the reaction product of 1-chloromethylnaphthalene and hydroxyethyl polyethylenimine.

Claim **52** defines over the prior art of record because the prior art does not teach or suggest the method of claim 43 wherein the defect reducing agent is the reaction product of 1-chloromethylnaphthalene and hydroxyethyl polyethylenimine.

The prior art does not contain any language that teaches or suggests the above. Therefore, a person skilled in the art would not have been motivated to adopt the above conditions, and a prima facie case of obviousness cannot be established.

Claims 12 and 19 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Claims 33 and 52 would be allowable if rewritten to overcome the rejection(s)

under 35 U.S.C. 112, second paragraph, set forth in this Office action and to include all of the limitations of the base claim and any intervening claims.

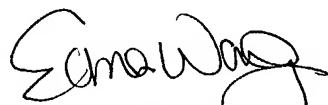
Any inquiry concerning this communication or earlier communications from the examiner should be directed to Edna Wong whose telephone number is (571) 272-1349. The examiner can normally be reached on Mon-Fri 7:30 am to 5:00 pm, alt. Fridays off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nam Nguyen can be reached on (571) 272-1342. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

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A handwritten signature in black ink, appearing to read "Edna Wong", with a large, stylized loop at the end.

Edna Wong
Primary Examiner
Art Unit 1753

EW
March 18, 2004